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CHARLES H. CLARK, *Managing Editor,*

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Editorial and General Offices: 65 Franklin St., Boston, Mass.

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Annual Meeting and Dinner

New York, N. Y., Sept. 23.—At the fourth quarterly meeting of the Board of Directors of U. S. Institute for Textile Research, Inc., held at the Hotel Pennsylvania today, committees were appointed and arrangements discussed for the seventh annual meeting to be held in this city Thursday, Nov. 5. The following committees for the annual meeting were appointed by Dr. E. H. Killheffer, who as first vice-president acted as chairman of the Board meeting:

Nominations—W. E. Emley, *Chairman;* Alban Eavenson, Dr. H. DeW. Smith.
Meeting—William W. Buffum, *Chairman;* C. H. Clark.
Auditor—William W. Buffum.

The meeting and dinner will be held at the Waldorf-Astoria Hotel, New York, N. Y.; the formal annual meeting of members for presentation of reports and election of new directors, and the succeeding meeting of directors for election of officers will be held prior to luncheon. It is tentatively planned that the afternoon will be devoted to reports and discussion on certain important researches in progress or being organized; this session to be sponsored by the Research Council of which W. E. Emley is chairman.

Members will be privileged and urged to entertain guests at the dinner. Hon. Francis P. Garvan, president of U. S. Institute, will preside, and, in addition to one other notable speaker, Dean Joseph H. Willits of the Wharton School, University of Pennsylvania, has been asked to attend as the guest of U. S. Institute and explain the plans, objectives and progress of the study of "Production and Distribution Organization in the Textile Industry" that is being conducted under his direction. This study is being financed by The Textile Foundation, was suggested and is being conducted under the advisory supervision of U. S. Institute's Committee on Economic Research, and has the endorsement and co-operation of practically all of the leading associations of textile manufacturers and merchants.

Plans for this seventh annual meeting and dinner will be perfected as far as possible at an early conference of the com-

mittee on meeting and officers of U. S. Institute, and the tentative program then will be forwarded to members and the Trade Press. Meantime, members are urged to reserve the date, and plan to be present with their guests.

* * *

Properties and Serviceability of Silk Dress Fabrics

A STUDY of the serviceability of 69 silk dress fabrics was started during the spring of 1930 by the American Home Economics Association with the co-operation of college students and teachers, and the National Bureau of Standards. According to the latter's *Technical News Bulletin* for September, the students purchased silk fabrics in the local stores, made dresses for themselves, and observed the performance of the dresses in service, all as a part of their class assignments. Samples of the fabrics were analyzed and tested at the Bureau, and 23 of the dresses showing the results of wear were examined, along with reports on their behavior in service. In addition, five reports of serviceability, submitted without the corresponding dresses, were examined.

Good correlation was found between the results of laboratory "performance" tests on color fastness, breaking strength, and aging characteristics of the fabrics, and the behavior of the dresses in service. In addition to these properties, resistance to yarn slippage at the seams and in the fabric is important. No relation between the serviceability of the dresses and the construction or price of the fabrics was indicated.

These results point to the practicability of evaluating dress fabrics by performance tests and of setting up standards for serviceability on this basis. Methods for determining these important properties were recently brought together in Commercial Standard CS 59–36, "Woven Dress Fabrics —Testing and Reporting," at present available in mimeographed form, and which will soon be obtainable as a printed publication.

* * *

Conference Number of *J. T. I.*

THE July issue of *The Journal of the Textile Institute* contains, in addition to its regular features, the papers and proceedings of the annual conference of The Textile Institute, held in London, Eng., June 3 to 5 inclusive. The papers were addressed to the conference subject of "The Production and Properties of Textile Fibres," and the authors included most of the leading British authorities on both branches of the subject. This volume of 294 pages, which may be purchased in Great Britain by non-members at five shillings, is, therefore, a very complete review of existing practical and scientific information on textile fibres. It is an important addition to any textile library.

An interesting and informative feature of the conference was an exhibition of scientific apparatus relating to textile research and testing. This was arranged in two sections: one devoted to trade exhibitors, and the other to exhibits by research associations and educational institutions. Other features of the conference were awards of Institute medals for notable textile achievements, and the delivery of the Mather lecture; the latter is also one of the Textile Institute's methods of focusing attention upon textile achievement. The Mather lecture for 1936 was delivered by Dr. Ernest Goulding, for many years fibre expert at the Imperial Institute, on

"Textile Fibres of Vegetable Origin: Forty Years of Investigation at the Imperial Institute."

The Conference Papers

The conference papers, all of which have been reviewed for the Abstract Section of *Textile Research*, were as follows:

"The Molecular Structure of Cellulose: A Review of Current Theories," G. F. Davidson, B.Sc. (British Cotton Industry Research Association).

"Wood Pulps for the Rayon Industries," L. Hebbs, A.I.C. (Cross & Bevan, London).

"Some Characteristics Which Enter into the Assessment of Wool Quality and Their Estimation," A. B. Wildman, Ph.D., B.Sc. (Wool Industries Research Association).

"The Past and Future of Flax Production in Great Britain," G. O. Searle, B.Sc., P.A.S.I. (Linen Industry Research Association).

"Some Fundamental Principles of Raw Wool Washing," H. Phillips, D.Sc., F.I.C. (Wool Industries Research Association).

"The Cleaning of Wool by Low Temperature Treatment," S. Townend, Ph.D. (Wool Industries Research Association).

"The Reactivity of the Sulphur Linkage in Animal Fibres," J. B. Speakman, D.Sc., F.I.C., F.T.I. (The University, Leeds).

"American Research in Cotton Harvesting and Ginning," A. F. W. Coulson, B.Sc. (R. Greg & Co.).

"The Sorptive Properties of the Silk Fibre," R. Cuthill, M.Sc., Ph.D. (Bradford Technical College).

"Recent Advances in the X-ray Study of Protein Fibres," W. T. Astbury, M.A., F.Inst.P. (The University, Leeds).

"The Separation of Flax Fibres from the Plant Stem," W. H. Gibson, D.Sc., O.B.E., F.T.I. (Linen Industry Research Association).

Drying and Chemical Processing

RECOGNITION of the importance in dyeing, and in chemical processing generally, of the effect of drying temperatures and other drying conditions and effects, is given by the New York Section of the A. A. T. C. C. in their selection for the subject to be discussed at their next meeting, Nov. 20, at the Chemists Club, New York City, "Drying of Textile Fabrics." It is well-known that much of the imperfect work for which dyers and finishers are blamed is not their fault, but is due to the delivery to them of goods that have been damaged by improper drying. It is also true that some dyers and finishers are handicapped by inefficient drying machinery and methods. The importance in chemical processing of textile fibres and products whose natural properties have not been impaired by improper drying was insufficiently emphasized at the conference on drying held under the auspices of U. S. Institute last May, and it is to be hoped that the meeting at the Chemists Club next month will illuminate adequately this phase of the subject.

The Specification of Color Tolerances

By DOROTHY NICKERSON*

MANY methods for judging color differences are used in laboratories and shops. They vary from the simple method of direct comparison by eye (used by expert matchers, classers, and graders) to comparisons of measurements made on beautifully adjusted, highly intricate, automatic instruments. Between these extremes are a great variety of instruments by means of which the colors may be compared.

Measurements made on such instruments are expressed in a wide variety of terms. Some results are expressed directly in terms of instrument operation, *e.g.*, in terms of particular filters used in the instrument. Others are expressed in terms translated from those of instrument operation to terms more expressive of the "color" of the sample.

The specification of color tolerance may be a problem quite distinct from that of color measurement, depending upon the type of instrument used, and the definition of "color." If color is defined the way it looks to the observer, that is, as "the general name for all sensations arising from the activity of the retina of the eye and its attached nervous mechanisms," as it is in the report of the Colorimetry Committee of the Optical Society of America,[1] results taken in terms of instrument operation must be translated if they are to be expressed in color terms. Given the above definition, color may be described in terms of three attributes: hue, brilliance or lightness, and saturation.

Regarding the measurement of color, the O. S. A. report says: "The three attributes of color can be treated as quantities and specified numerically, if all discriminable colors are conceived to be arranged into a system such that neighboring members differ from one another in each of the three attributes by just noticeable degrees (or threshold steps). Such a system (vide infra) is necessarily three-dimensional, and three ordinal values, representing the positions of a given color in the several dimensions, are needed to define the color."

In work which the writer has been doing for several years, the Munsell system and notation have been adopted as being the nearest practical approximation to the sensation scales of hue, brilliance, and saturation that is available. In this system, the scale set up for each attribute consists of equidistant steps. Only the brilliance, or value, scale has been described in the scientific literature,[2, 3] but a study of the charts themselves,[4] which were made to illustrate the idea of the Munsell system and notation, will give anyone first-hand information regarding the adequacy of the equal-stepped arrangement. The steps within any one attribute are approximately equal,† but the unit steps between attributes are not equal. Experimental

* Color Technologist, Bureau of Agricultural Economics, U. S. Dept. of Agriculture.

† There are, of course, irregularities in the color chips on the charts illustrating the Munsell system and notation, but on the whole they are remarkably good. See B. S. Technologic Paper No. 167, 1920, by Priest, Gibson, and McNicholas, An Examination of the Munsell Color System, which refers to the original Atlas of the Munsell Color System.

work regarding the interrelation of these steps has been done in the Munsell laboratories, particularly by Godlove, and in the painting of a series of hue, brilliance, and chroma scales in very small steps. At middle value and chroma (5/5) a 100-step hue scale was produced, a 60-step value scale, and a 30-step (0–10 chroma) chroma scale. Results of these studies are unpublished, but they are not very different from the relation determined some time ago by the writer, a relation which seems adequate until more exact data are available. This approximation indicates that 1 value step is about equally perceptible to 3 hue steps (out of 100 at /5), or to 2 chroma steps.

In a recent paper, before Committee D–13 of the A. S. T. M., the writer suggested that fading results be expressed in color terms, and that work be done to complete a satisfactory formula for an Index of Fading, based upon the formula

$$I = (C/5)\,dH/3 + dL + dC/2$$

where I = Index of Fading, H = hue, L = lightness (brilliance, or value), C = chroma, and d = difference. The (C/5) function must be included to take care of the change in number of perceptibly different steps in hue as the chroma increases or decreases from /5.[a]

Such a method is the only logical one upon which color tolerances can be discussed, for only when color is reduced to equally stepped sensation scales can one use the same units and have them refer to the same size of color differences regardless of the color under discussion. It is often said that the psycho-physical concepts of dominant wavelength, brightness, and excitation purity are the physical analogs of hue, brilliance, and chroma, but this is not true except in a very general sense. There is a relation between hue and dominant wavelength but the units are not related 1 to 1, nor in any other simple or direct manner. Ten hues, as arranged in the Munsell system, are equally spaced to the eye,[b] and have 10 hue units between adjacent hues. Between R and YR, between YR and Y, between B and PB, or between any other two adjacent principal hues, there are 10 hue steps. The corresponding wavelength differences according to measurements made on samples of maxima colors [b1, 12] are 32 mμ between R and YR, 11 mμ between YR and Y, and only 7 mμ between B and PB.[b2, b3] The correspond-

Refer also to an unpublished thesis by Glenn and Killian on Trichromatic Analysis of the Munsell System, the analysis obtained by computation from spectral reflectance of the Munsell samples under the direction of Professor A. C. Hardy at M. I. T. (1935). This report refers to the present Munsell Book of Color. It is expected that the data will be published in the forthcoming report of the O. S. A. Colorimetry Committee.

[a] The present form of this formula supposes that an additive function is involved. Further experimental work should be done on this point, to arrive at the correct, rather than an approximate form for this formula.

[b] For an average background and usual illumination.

[b1] Computations for 5 m intervals given in Table II, the x-y results converted to dominant wavelength from tables in Hardy's recently published Handbook of Color, Technology Press, Cambridge, Mass.

[b2]

Complete series for differences between principal Munsell hues	Wavelength difference
R to YR	32 mμ
YR to Y	11
Y to GY	9
GY to G	52
G to BG	25
BG to B	9
B to PB	7

[b3] Unpublished data in the files of the Munsell Company, based on work done at the Bureau of Standards, indicate that when wavelength differences of 50 equally stepped hue papers at 5 value and chroma are plotted against wave-

ence between hue and dominant wavelength is neither simple nor direct, and one cannot set a tolerance of 1 or 2 mμ in dominant wavelength and have the results equally different to the eye, regardless of whether reds, blues, or greens are concerned.

The same is true for brilliance, but in this case the relation between brilliance and brightness has been carefully studied and is well established for several backgrounds and conditions of illumination. The Munsell value scale, for example, differs from the physical measurement of "percent light reflected," or from psycho-physical "brightness," in the fact that each unit in the value scale is equal to the eye, while in the brightness scale each unit is equal to the percentage of light reflected. For example, a paper having a Munsell value of 5/, a color half way between black and white to the eye, actually reflects only 18% of the light falling on it. And 18% is a long way from 50%, which it would have to be if the eye measured in equal units of "percent reflectance."* If a difference of 2% in brightness were established as a tolerance for a certain line of textile materials, the difference in the blacks would be far beyond the limits of an acceptable match, while in the light colors, such a tolerance would be entirely too difficult to meet.

In regard to the correspondence between chroma and colorimetric purity, the story is the same. A tolerance expressed in colorimetric purity, when applied to light colors, would often give twice as large a visual tolerance for light colors as it would for dark colors. A case in point would be a tolerance for colorimetric purity applied to a red having a figure of about 60 for colorimetric purity. If such a number occurs when the brightness is about 6%, the chroma will be about 14, a very strong but dark red that can be produced in a textile. But if the same number for colorimetric purity should be applied to a brightness of 60% instead of 6%, the chroma would be about 30, a color twice as strong visually as when applied to a 6% brightness level. In fact, it would be a color never yet produced in a textile, which is not surprising, since according to the very useful figures published by MacAdam[5] regarding visual efficiency, it would be a color impossible to produce. A tolerance figure expressed in terms of colorimetric purity which could be applied satisfactorily in one case would have to be changed to apply in another case. It would seem more useful, then, to apply color tolerances in terms of units that are equal to the eye.

To understand how it is possible to arrive at an expression of color in equally stepped scales, it is necessary to go back to 1931. In that year there met at Cambridge, England, a group of men† who adopted a series of specifications now known as the I. C. I. specifications: (1) for a hypothetical observer to be used as standard in color specifications, (2) for illuminants to be considered as standard, (3) for mode of illuminants, angle of regard, etc., and (4) for conventions as to reference stimuli, units, and systems of trilinear coordinates to be used in specifying color stimuli.[6, 7, 8] These specifications mark the beginning of a new era in the science of

length, the maxima of the curve come at wavelengths below 470, about 530, and above 620 mμ. The minima come about 490 and 580 mμ. It is of interest to compare these maxima and minima to those of curves for hue sensibility data already published.

* If one does not wish to go all the way and use Munsell value, then "brightness" results can be related to visual results better by use of a logarithmic than an arithmetic scale.

† The Colorimetry Committee of the International Commission on Illumination.

colorimetry.[a] Their adoption does not mean that all color problems can now be solved with ease, but it does mean that a universal language has been found for converting fundamental, objective specifications of color stimuli, or of equivalent stimuli, into subjective specifications of color from which any layman can tell what the color "looks like."

The I. C. I. data do not, in themselves, provide a subjective specification, but they do provide a language of exchange by which stimulus terms can be converted to sensation terms descriptive of the color. If I. C. I. tristimulus values for equally stepped color scales are available, then I. C. I. tristimulus values of results on any type of instrument may be compared to equivalent tristimulus values for equally-stepped color scales, and the equivalent color measurement determined as it looks to the eye, not as it reads to the machine.

Before this can be done in practice as well as theory, it is necessary that I. C. I. tristimulus values of a series of equally stepped scales be available. Fortunately, in Professor Hardy's laboratory at the Massachusetts Institute of Technology, Glenn and Killian have measured the present series of Munsell colors,[9] and although the data are not yet published,[b] a preliminary report has been made available for study. On the basis of this work Judd, Nickerson, *et al*, are reviewing the spacing of the Munsell colors, since it seems that, however valuable the publication of the raw data may be, competently smoothed values will be of more practical use. The purpose is to smooth the values in such a way as to perpetuate the advantages of the Munsell system without perpetuating local or general irregularities which appear in the charts of the Munsell Book of Color. Meanwhile, the raw data are extremely useful, in that they provide sufficient material for investigating the problem of color tolerances.

Nutting has recently published in this journal[10] excellent material for use in making a study of color tolerances. The writer cannot agree that he has really discussed a method that will satisfactorily answer the problem of tolerance specification, for he suggests the use of dominant wavelength, brightness, and colorimetric purity, and by that method a different tolerance specification would be necessary for every color. The data, however, include I. C. I. tristimulus values for each color, and from them the Munsell hue-value-chroma factors may be obtained by reference to graphic arrangements of the Glenn-Killian data.

On Fig. 1 are plotted the hue/brilliance/chroma results obtained in this way for 19 pairs of cotton samples supplied by a cotton manufacturer to Dr. Nutting as matched samples. On Fig. 2 are the figures for a series of matched woolen samples; their Munsell values are plotted, and from them it is possible to make a study of tolerances. For example, the average hue/value/chroma differences for the cotton samples that were considered matched are twice the size of those for the woolen samples, indicating (if there are enough samples included to provide sufficient basis for generalizing) that color tolerances in commercial matches of wool fabrics are twice

[a] For years previous, the Colorimetry Section of the National Bureau of Standards, under the leadership of Mr. Irwin G. Priest in this country, members of the staff of the National Physical Laboratory in England, and members of other nations on the committee, had been working toward this end. It was owing particularly to the efforts of Mr. Priest that the work came to such a satisfactory conclusion. All tribute should be paid him for the part he played in this conference, a last great part played in the interest of the science to which his life was devoted.

[b] They will be published in the forthcoming revision of the report of the Colorimetry Committee of the Optical Society of America.

as strict as the tolerance allowed in matching cotton fabrics. The average figures for hue/value/chroma differences in 19 pairs of cotton samples are 1.5/0.18/0.4, while for 22 pairs of woolen samples they are 0.7/0.09/0.2. Further analysis shows that 58% of the cotton matches, and 77% of the woolen matches, were within a one step hue tolerance. For lightness, 36% of the cotton, and 68% of the woolen matches, were within 0.10 steps of lightness. For chroma, 79% of the cotton matches, and 86% of the woolen, were within 0.5 chroma steps of each other.

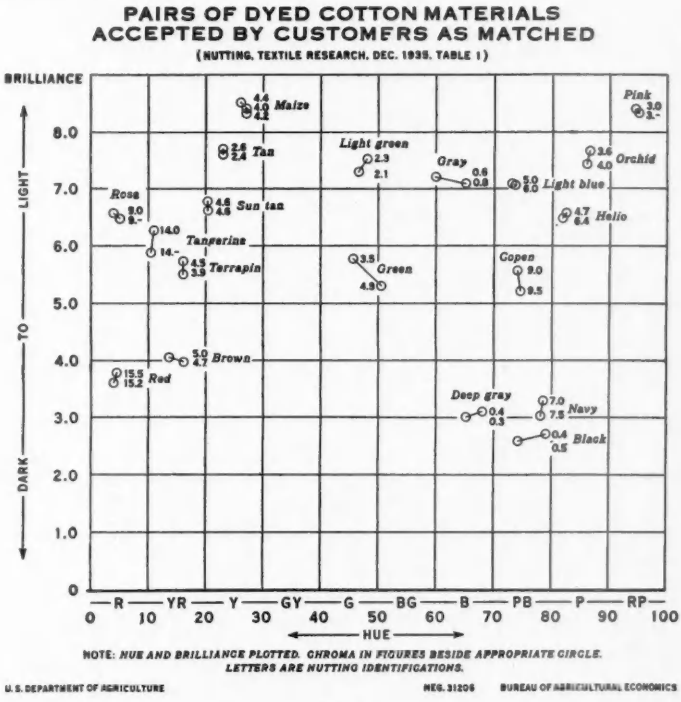

FIG. 1

On the basis of such figures a tolerance may be established. If it is desirable to express it in one figure, the method suggested for working out an Index of Fading may be used. If the unit " I " is adjusted to a difference visually equal to ⅓ chroma step, as suggested by Subcommittee A–7 of Committee D–13 of the A. S. T. M. for the color tolerance in their definition of the term "Fast to Washing," the formula becomes $I = (C/5)d2H + 6dL + 3dC$. On this basis the average difference for cotton samples, based on the matches supplied to Dr. Nutting (supposing the average

chroma of the samples to be /5), is 5.3 units, while that of the woolen samples is 2.5 units, indicating that the average of commercial color matches, illustrated by the series supplied to Dr. Nutting, is 5.3 and 2.5 times the color difference that would be considered satisfactory in a fast-to-washing test.

If tolerances for commercial matches are as great as this, it is of interest to compare them to differences considered important in fading test results. The data shown on Fig. 3 were obtained on a series of woolen

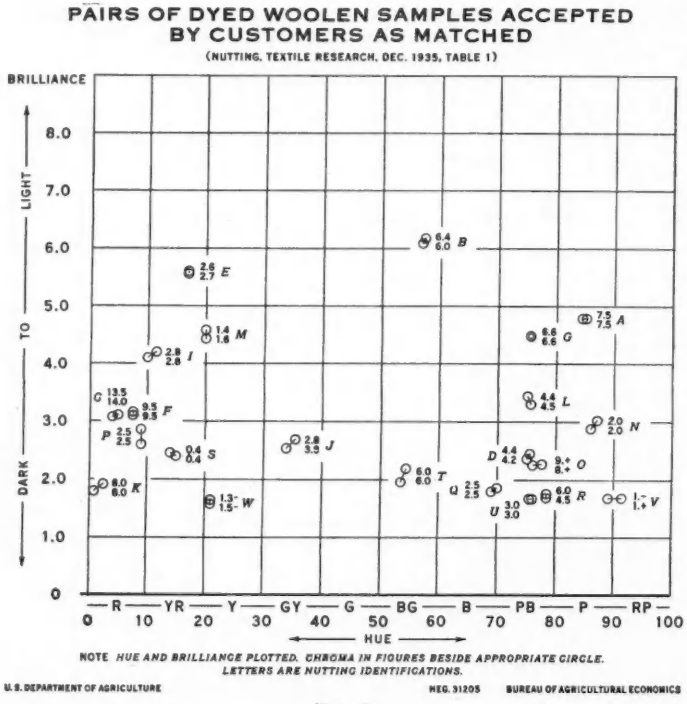

FIG. 2

samples faded at the Textile Section of the National Bureau of Standards, and measured for color in the color laboratory of the Bureau of Agricultural Economics. The work was done by Marian A. Belknap in preparation of a thesis for a Master's degree in home economics at George Washington University.[11] It is evident from a study of Fig. 3 that differences caused by fading are fairly small for most of the samples for 10 and 20 hour fadings. But in order to compare wide differences, the 80 hour result is compared with the original. For the 12 samples in the test, the average

hue/value/chroma change for 80 hours of fading was 2.0/0.52/2.2. Comparison with the average figures for commercial matches of woolen samples (0.7/0.09/0.2) indicates that 80 hours of fading changes the average color of these samples very much more than could possibly be considered a good commercial match. It indicates also that the greatest relative change occurs in chroma, although there is also a large change in lightness.

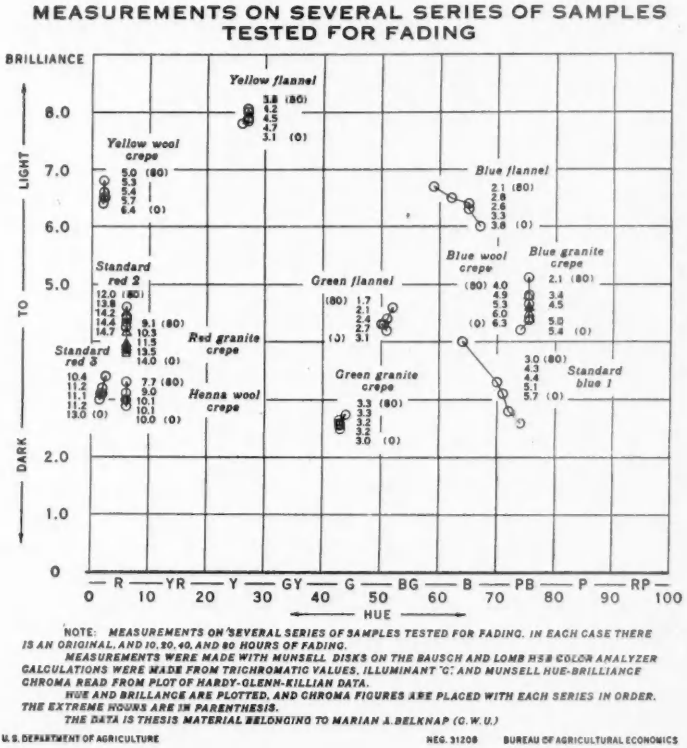

FIG. 3

Standards I, II, and III, of the American Association of Textile Chemists and Colorists, were included among the samples, Standard I representing the greatest amount of color change for which they provide standards. Standards with higher numbers indicate closer tolerances. By reference to Fig. 4, Standard I is shown to have wide color differences; Standards II and III show relatively smaller differences. The "I" factor for these changes may be computed, and will show, of course, a much larger

total difference in color No. I Standard than for No. II, or No. III.* It may be noted that in fading work, the tolerance for hue change may be reasonably small, while tolerances for chroma—if these series provide a good statistical sample—must be considerably larger than they would be for other types of color work in which the chroma differences may more readily be controlled.†

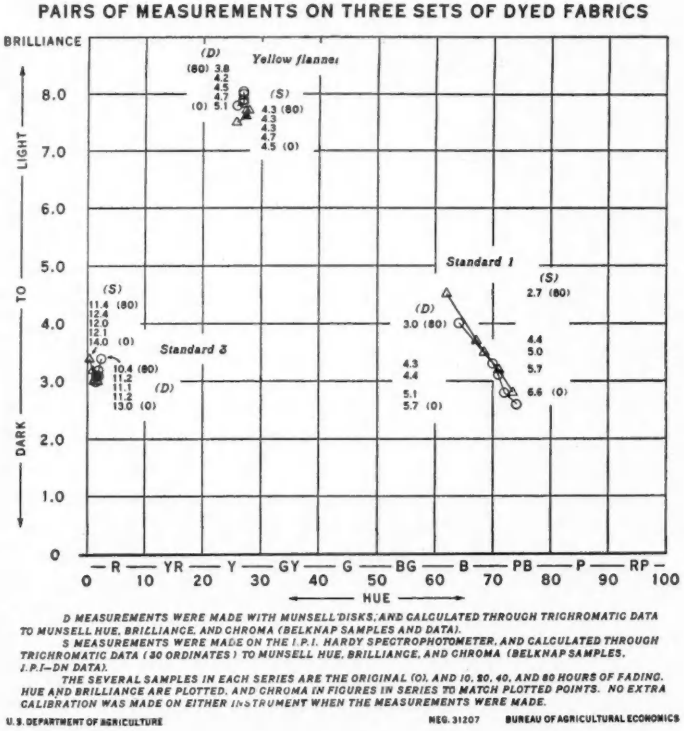
PAIRS OF MEASUREMENTS ON THREE SETS OF DYED FABRICS
BRILLIANCE
LIGHT TO DARK
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
(D) (80) 3.8 4.2 4.5 4.7 (0) 5.1
Yellow flannel
(S) 4.3 (80) 4.3 4.3 4.7 4.5 (0)
(S) 11.4 (80) 12.4 12.0 12.1 14.0 (0)
Standard 3
10.4 (80) 11.2 11.1 11.2 13.0 (0)
(D)
Standard 1
(S) 2.7 (80)
(D) 3.0 (80)
4.4 5.0 5.7 6.6 (0)
4.3 4.4 5.1 5.7 (0)
R YR Y GY G BG B PB P RP
0 10 20 30 40 50 60 70 80 90 100
HUE
D MEASUREMENTS WERE MADE WITH MUNSELL DISKS, AND CALCULATED THROUGH TRICHROMATIC DATA TO MUNSELL HUE, BRILLIANCE, AND CHROMA (BELKNAP SAMPLES AND DATA).
S MEASUREMENTS WERE MADE ON THE I.P.I. HARDY SPECTROPHOTOMETER, AND CALCULATED THROUGH TRICHROMATIC DATA (30 ORDINATES) TO MUNSELL HUE, BRILLIANCE, AND CHROMA (BELKNAP SAMPLES, I.P.I.—DN DATA).
THE SEVERAL SAMPLES IN EACH SERIES ARE THE ORIGINAL (0), AND 10, 20, 40, AND 80 HOURS OF FADING. HUE AND BRILLIANCE ARE PLOTTED, AND CHROMA IN FIGURES IN SERIES TO MATCH PLOTTED POINTS. NO EXTRA CALIBRATION WAS MADE ON EITHER INSTRUMENT WHEN THE MEASUREMENTS WERE MADE.
U.S. DEPARTMENT OF AGRICULTURE
NEG. 31207
BUREAU OF AGRICULTURAL ECONOMICS

FIG. 4

* It should be kept in mind that while the suggested formula for "I" can be used at present, experimental work still needs to be done to make it completely satisfactory. The layman, or the commercial or industrial man, always asks for results in a single figure that will be "easy to understand." The time will come when he can have a single figure for "total color change," but by that time he will probably know enough more about color to realize that for most problems he needs to know the hue/value/chroma differences that make up this total difference. For example, the difficulties involved in adjusting a hue difference may be much less than those involved in making a chroma match, and he therefore needs to know in which factor there is the most difference.

† It is obvious that many samples must be measured to provide an adequate sample for statistical treatment if generalizations are to be made correctly.

Indications of differences in color on Figs. 2 to 4 provide data from which rough tolerance specifications might be drawn—the tolerance limit to depend upon the application. In this connection, it might be well to know something about the difference between results obtained by matching on instruments that work on entirely different principles. Much has been said concerning the possibility of converting readings made on various types of instruments to a single notation, but little actual work of this nature has been done.[12] The measurements of fading of these woolen samples were made on the Bausch and Lomb HSB color analyzer. "C" illumination[13] was supposed, and the tristimulus values of the disks were used to calculate the trichromatic value of the match for the sample. The trichromatic values were read off in Munsell hue/brilliance/chroma from the Glenn-Killian data plotted by value levels.

The differences in a few of the samples were so extremely small, the results in some cases not following the expected trend from a progression of 10–20–40–80 hours of fading,* that it seemed advisable to run a check series of measurements. Visual observations were not conclusive, for it was impossible to tell, with the faded areas separated, in such small color changes, whether the differences were within the eye-and-instrument tolerance of observation. Therefore, it seemed desirable to check the results of the visual instrument with results of a non-visual instrument. Through the cooperation of the color measurements laboratory of the International Printing Ink Corporation, curves were drawn on their automatic G. E.-Hardy color analyzer, of a series of three samples, each sample consisting of the original, with portions faded 10–20–40 and 80 hours each. The same inconsistencies that had been found by the use of the visual instrument were found with the non-visual spectrophotometer. There was no thought at the time of making anything but a comparative check, therefore neither instrument was used with more than usual care; the samples were backed on the disk instrument with several layers of the same material, while on the spectrophotometer they were backed with a middle value gray; the illumination in the Bausch and Lomb instrument approximates the I. C. I. "C" illumination, but not accurately. Therefore it was surprising and extremely gratifying to find, after tristimulus values had been calculated from the spectrophotometric curves by the Hardy 30-ordinate method, that the Munsell values read from the Glenn-Killian data gave results as close to the values arrived at from disk measurement as some of those called good color matches in commercial practice. Fig. 5 shows the results on three sets of faded samples, both by use of the visual disk method and by use of an automatic photocell spectrophotometer. If care had been taken to keep all possible conditions alike in making the two matches, the agreement would undoubtedly have been better. At any rate, the results are shown to illustrate that this method of tolerance specification may be based on a conversion of measurements made on widely different instruments. It might be noted, since tolerance specifications deal with relative differences, that however desirable it may be for absolute values to check accurately by several methods, relative results are all that are necessary for tolerance specifications.

From the foregoing discussion it should be clear that tolerance specification for color is truly a problem distinct from that of measurement by instrument. Measurements of color or of color stimuli may be made on

* *E.g.*, 20 and 30 hour results on Standard III.

many types of instruments, but unless the results are converted to equally stepped sensation scales, a tolerance specification cannot be drawn that will apply to all colors. Tolerance specifications for any particular color may be made in instrument terms, but if a tolerance of "just perceptible" (or of 5 times "just perceptible") is wanted for all colors going out of a particular factory, it is necessary, unless every color is to have its own specification for use in meeting that tolerance, to use a method of converting instrument readings that will provide results directly in just-perceptible steps, or indirectly in terms of equally stepped scales of hue/brilliance/chroma.

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A New Method for Measuring Pebble

By DR. IRVING J. SAXL *

Summary

A new method is described for determining quantitatively the surface pattern of textile materials. The process consists substantially in making a casting in plaster of Paris of the textile material and investigating the relief structure of same either by optical or mechanical enlargement of the profile in the direction of the warp and the filling.

Introduction

AT a meeting of the U. S. Institute for Textile Research at the Hotel Waldorf-Astoria in November 1935, the writer suggested for the purpose of identifying fabric structures, particularly as they refer to crêpe and pebble fabrics, the use of the customary physical expressions of number of waves, per length unit and amplitude of these waves, for defining the degree of pebble and surface roughness. This definition has been accepted, and expressions, such as number of waves per inch and amplitude of the wave, have been used since. However, the determination of numbers of waves and their respective amplitude, meets occasionally with difficulties if pebble patterns of rather non-uniform structure are investigated. Therefore, a method has been developed, involving a simple procedure that can be reproduced easily, and that lends itself to the routine measurements of the average textile laboratory.

Preparation of the Cast

It has been observed that the difficulties of measuring the surface conditions of fabrics are due primarily to the irregular structure of the surfaces, and also to the fact that these surfaces are soft textile materials which can be investigated under the same conditions only with difficulty because they are liable to change their structure under the influence of mechanical forces. It has been considered a necessity, therefore, first, before entering upon any such investigations, to bring the surface of the fabric into a fixed and stationary condition which would permit a quantitative reproduction of measurements. In order to arrive at this result, the following procedure has been developed:

A piece of cloth, for instance of crêpe, the surface structure of which is to be determined quantitatively, is fastened without stress on a cardboard plate with needles or clamps. Thereafter, olive oil is cast over the cloth and distributed with a camels-hair brush, care being taken that the structure of the fabric is not changed. The excess of the olive oil is permitted to drop off. The cover of oil is applied to the textile material in order that the subsequent cast does not stick to the fabric.

* Consulting Physicist, Providence, R. I.

A diluted suspension of fine plaster of Paris is then made and agitated until the air bubbles have disappeared. This suspension in water of ap-approximately 10% plaster of Paris is highly liquid. It is cast upon the cloth that has been prepared with oil in the aforesaid manner. The excess plaster of Paris is shaken off and the material is permitted to dry until a thin layer of plaster of Paris has settled upon the cloth and is still in a moist state. A ring of paper or cardboard is then placed upon the thin plaster of Paris surface. A more concentrated mixture (25% plaster of Paris in water) is then poured into the ring and allowed to settle and harden. In order to facilitate the later handling, the height of the entire model should be less than one quarter of an inch.

After the cast has hardened sufficiently (usually within approximately two hours) the needles that hold the cloth to the cardboard underlayer are removed and the entire cast lifted up. By carefully pulling the cloth away from the cast, it can be lifted from the latter easily.

It will be found that the structure of the cloth has been reproduced quantitatively in the cast, the latter being an exact replica of the original cloth surface.

Examination of the Sample

The cast made in this manner can be investigated in various ways, and will show clearly in the plaster of Paris reproduction as small details as the individual yarn.

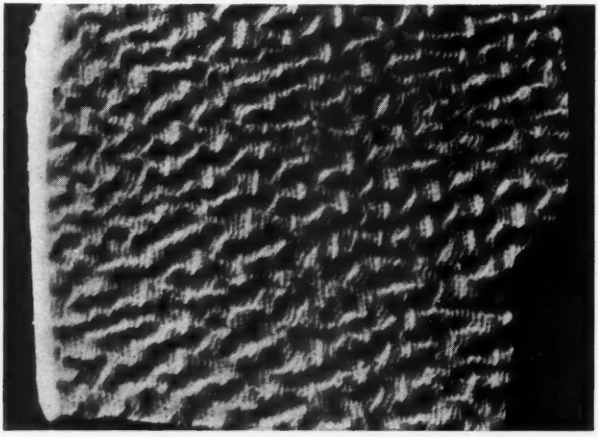

FIG. 1. Plaster cast of crêpe cloth, showing pebble.

Fig. 1 is a photograph of pebble cloth in the plaster of Paris model. It is a simple matter to cut the plaster cast with a sharp razor blade, and to examine the resulting cross-section.

It is possible to make cuts in this cast both in the direction of the warp as well as of the filling. These cuts can be examined under a mag-

nifying lens or under a microscope, and the fine structure of the textile material can be investigated in this manner thoroughly.

Another method of enlarging the surface structure of the textile material consists in having the feeler of a profilograph brought in contact with the relief of the plaster cast, and mechanically or electrically to amplify and record the deviations of the needle.

Fig. 2 shows an enlarged picture, made of the cross-section of a cast, which was cut in the direction of the filling over the total length of one inch. This cast was made of a rayon crêpe, the filling of which consisted of 200

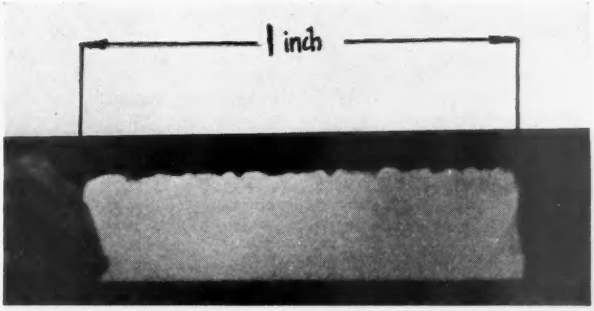

FIG. 2. Cross-section of cast of crêpe cloth (enlarged 2½ times) showing amplitude and number of waves.

denier, 75 filament, semi-dull Viscose yarn. The crêpe is a 4 x 4 construction.

While plaster of Paris has been used for the purpose of making these reproductions of surface effects, it is possible, of course, to use other materials. Among these, various waxes and other plastic materials may be taken into consideration. Plaster of Paris, however, combines the desirable features of being applicable in such fine form that it covers and reproduces individual yarns, and, in addition, hardens so completely that the cast is reasonably protected against mechanical deformation.

"As I understand my economic friends there is general agreement among them that the only way to improve appreciably the general well-being of this country is in some way to increase the total quantity of goods and services to be consumed, i.e., to get us all to working more effectively or harder or longer. That is precisely what your research activities are aimed at, namely to produce more and better goods at lower cost so that more people can enjoy them. That as I see it is, both from your point of view and that of the country, the correct approach to the problem." From Address of Dr. Robert A. Millikan to U. S. Institute, Nov. 14, 1935.

The Chemistry of Cellulose

By DR. WANDA K. FARR*

IN discussing the chemistry of a substance it is often advisable to mention at the outset a few of its fundamental properties. It is with regret, therefore, that I must acknowledge that cellulose has no known fusion point, will not dissolve in ordinary solvents, has an undetermined molecular weight, and that even its chemical formula is the subject of frequent re-investigation. A very long list of uncertainties might be compiled. It is probably well, however, to follow the example of a contemporary worker who, when confronted recently with the task of defining cellulose, said, "Cellulose is a substance which is little known, but extremely important."

A few general points of information concerning cellulose membrane formation have been clearly established. Cellulose is, in the first place, a product of the living protoplasm of most plant cells and, once formed, it is used most extensively to build a wall around the living protoplast. It is to these cell walls that the plant is largely indebted for its form and rigidity. Industry likewise is dependent upon them as a source of one of its most valuable and widely used raw materials.

For the past century both botanists and chemists have been aware of certain definite characteristics of cellulose membranes. Their double refraction in polarized light indicated that they were made up largely of crystalline material. They were also observed to swell when moistened with water, but when subsequently dried they showed no evidence of change during the swelling process. Since no crystalline structures were readily visible with the microscope, the crystallites were supposed to be "submicroscopic." The fact that there was no evidence of change after the treatment with water indicated that the water had not combined chemically with the crystallites but that it had merely pushed them apart during the membrane enlargement. These general considerations formed the basis for the commonly accepted idea that the cellulose membrane of the cotton fibre and many other plant cells is formed by the deposition of microscopically invisible units of cellulose. The size of these units has been controversial. Their supposed invisibility has necessitated theoretical interpretations of both botanical and chemical data in this field of research.

Contrary to this view, it has been observed by the author, in collaboration with Dr. Sophia H. Eckerson, that the cellulose membranes of plant cells are formed by the deposition of microscopically visible ellipsoid particles approximately six-one-hundred-thousandths of an inch long and four-one-hundred-thousandths of an inch broad. Previous identification failed because of the thin layer of glue-like substance which coats each particle and masks the real cellulose beneath. This surface coating plays a most important part in the actual cellulose membrane formation, however, by cementing together the particles.

* Chemist, William Boyce Thompson Research Institute. A paper read at the Second Dearborn (Mich.) Conference under the auspices of the Farm Chemurgic Council and the Chemical Foundation, Inc.

In the young cell the membrane upon the surface of the protoplast contains no cellulose. The cellulose particles are in the interior of the cell scattered throughout the viscous protoplasm, separate, or in bead-like chains. Their cellulose nature may be determined by their refractive indices (1.565 lengthwise, 1.530 crosswise), and by the fact that they swell and turn blue when treated with iodine and sulphuric acid. In later stages of cell development the bead-like chains, made up of single rows of particles joined end to end, are more numerous. Only after layer upon layer of these rows of cellulose particles have been applied to the inner side of the surface membrane of the cell, in much the same fashion that the plasterer applies plaster to the wall of the room, is the formation of the membrane completed.

The Cementing Material

Microchemical analyses also reveal something of the nature of the material upon the surface of the particles which cements them together to form the fibrils and the fibrils in turn to form the membrane. Solubility tests, staining reactions, and optical properties in polarized light, first indicated that it is largely pectic. More recently uronic acid analyses of the extracted cementing material have contributed additional evidence to this conception. It is obvious, however, that traces of many other substances commonly present in the living cytoplasm are mixed with this pectic material in the wall. By suitable treatment with pectic solvents, complete disintegration of the fibres takes place, thus making available large supplies of both cementing material and cellulose particles for detailed analysis.

Examination of the cellulose membranes of cells from various parts of the plant kingdom has shown, in every instance, cellulose particles held together by a cementing material. The presence of the cellulose particles accounts for the crystalline behavior of cellulose membranes in polarized light as well as for their ability to diffract X-rays. The behavior of the membrane constituents during the process of swelling is microscopically visible. The particles are seen to be pushed apart, not by water alone, but by the swelling of the colloidal cementing material which surrounds them. The presence of cellulose particles will account, therefore, for the observed crystalline properties of the membranes and the presence of cementing material for those of a colloidal nature. The physical and chemical properties of the separated cementing material are of special interest. This jelly-like substance which may be precipitated from weak acid or alkaline solutions in which cotton fibres have been immersed, closely resembles in appearance and behavior the pectic material which may be extracted from apple or citrus fruits. It is the "brick and mortar" relationship which exists between the cellulose particles and this substance which makes more understandable the remarkable physical properties of the cellulose membranes.

Future Cellulose Research

Future research in this field holds no single problem of greater importance than that of the origin of the particle itself. Although it reacts as a unit with the microscopic technique now available, there is no

reason to assume that it is made up entirely of cellulose. Special methods are now being developed to investigate this point. Until this information is obtained the cellulose particles cannot be classed with the giant molecules which have been shown to exist in proteins and certain organic materials other than cellulose. It is hoped that these studies will not only furnish evidence concerning the origin of these plant structures, but that they will also bring out interesting analogies between the modes of formation of two important plant products—starch and cellulose.

At the present time it is impossible to predict the value of these findings to either science or industry. Their greatest usefulness to chemists may consist in the substitution of observational data for the theoretical ideas of the past as a basis for interpretation. The cellulose industries are likewise furnished with a new conception of the chemical and physical nature of their raw materials. A study of the reactions of the separated membrane constituents to the various types of treatment involved in the manufacturing processes may help to eliminate variabilities which have led to much confusion. It must be mentioned, however, that an element of zest is added to our own experimental routine through the possibility that, at any moment, we may either find or produce something which is more useful than that which we have had before.

Obituary

GEORGE L. GILMORE, an original contributing member of U. S. Institute and the first president of Textile Research Council, one of U. S. Institute's predecessor organizations, died Sept. 13, after a long illness at his home in Lexington, Mass. He was born in Charlestown, Mass., March 29, 1868, and was graduated from Massachusetts Institute of Technology with the class of 1890, of which he had been secretary for many years. His whole business life was spent with the Middlesex Bleach, Dye and Print Works, Somerville, Mass., which was founded by his father, whom he succeeded as proprietor. This plant was one of the oldest of its kind in the country and was liquidated recently. Mr. Gilmore was a liberal supporter of trade association work both personally and financially, but he always preferred to act as a member and not as an officer. Although taking an active part in the founding of U. S. Institute, and in prevailing upon the late Dr. Samuel W. Stratton to become its first president, he declined official connection but was always a loyal supporter of its activities. George had the happy faculty of making friends easily and keeping them, and they are particularly numerous in the textile industry, not only in this country but abroad. His friends were always welcome to go through his plant, it being his belief that in most instances he got more out of these visits than they did. He is survived by his widow, Mrs. Jessie B., and by a sister, Mrs. William W. Reed.

Warp Sizing of Viscose Rayon

Outline Program of This Phase of U.S. Institute's Warp Sizing Research

THE first research report on the warp sizing of viscose-process rayon, and No. 4 of the warp sizing study of U. S. Institute for Textile Research, Inc., was mailed to co-operators in June. It reported "Effects of Various Types of Sizes on Viscose Rayon Warps." The basic features of this program were developed by the Administration Committee and Director and submitted to a conference of invited technicians and scientists. The final program is a result of their combined efforts, and as far as possible has been restricted to what may be termed most efficient standard practice. It includes the standards that have been adopted for materials and machines, subject to such changes as are indicated by preliminary laboratory analysis and experimental research in the mill.

Standards and Methods

(1) Yarn: 150 den., 40 fil. bright viscose-process rayon. Cone form. To be a regular delivery to mill in every case; not special lots for this study. Extensibility and other yarn variables to be recorded in reports.

(2) Warping: Silk type. Tentative standards for tension, speed and R.H. were adopted, and actual figures will be recorded and reported.

(3) Slasher: Multi-cylinder type. This adopted because of its flexibility, allowing for varying speeds, temperatures, moisture-content of warp, tension and stretch, which data will be recorded and reported.

(4) Sixing Materials: Laboratory analysis of materials to be used to precede the mill experimental research. The chemical and physical properties of starches, glues, gelatines, sulphonated oils, glycerines and blends of these, and also studies of load-extension, stiffness and cohesion of yarns from sized fabrics before and after finishing are to be studied and reported. Preservatives will not be used, but will be studied.

(5) Weave Room Conditions: Experimental research conducted on latest types of both bobbin- and shuttle-changing automatic looms. Warp, 100 ends per inch, 40-in. wide, drawn through four harnesses (steel or cotton). Harnesses, reeds, reed depth and all loom conditions selected and adjusted for maximum efficiency and production of as perfect cloth as yarn and sizing make possible, and without regard to filling defects. Analysis of various parts of the warp before and after weaving, and careful record kept of speed, tension, end-breakage, etc., during weaving, with causes of end-breakage. Records and analysis to be repeated for warps variously sized. It is proposed to operate the looms on the end portion of each variously sized warp as a break-down test, increasing from standard speed or pickage to a speed causing so much filament and warp abrasion and breakage as to render further operation impractical.

(6) Size Removal: Fabrics produced under the stated conditions and desized under practical finishing plant conditions will be carefully studied physically and chemically.

It is hoped that some enlightenment from an economic standpoint will result as to the comparative solubility of the various size mixtures used.

(7) Dyeing and Finishing: Fabrics will be dyed as well as finished under usual conditions, records being kept of methods employed and these and the results carefully studied for comparative valuation.

Co-operation and Future Plans

The initial mill research work was conducted at the plants of the Manville-Jenckes Co., Aspinook Co., and the Pacific Mills. For the balance of the experimental mill research on viscose-process rayons the Pacific Mills has kindly made available its equipment and a part of its personnel under the direction of Wright Bolton, agent of the company's Rayon Division, and chairman of U. S. Institute's Warp Sizing Administration Committee.

Plans for the study of acetate-process rayons have already been tentatively considered by the Administration Committee, and as soon as the viscose-process study is a little further advanced, Dr. Yelland, director of the study, plans to visit co-operating mills for the purpose of securing opinions as to proper procedure on the former, and to discuss progress of the latter study. Experimental research on starches and starch blends as sizing materials for viscose warps is adding to starch information previously accumulated, and eventually an effort will be made to correlate the data on 1% solutions with experimental work on concentrated starch solutions.

The warp sizing study has a specially equipped laboratory at Massachusetts Institute of Technology, where the research is being conducted through the Division of Industrial Co-operation and Research. Dr. W. E. Yelland is the director and he has as assistants C. B. Armstrong and H. H. Broadfoot. Dr. J. R. Katz is retained on a consulting basis. E. R. Schwarz, professor of textile engineering, acts as contact man at M. I. T. for the Warp Sizing Administration Committee, the members of which are as follows: Wright Bolton, agent, Rayon Fabrics Div., Pacific Mills, chairman; Dr. J. B. Quig, Du Pont Rayon Co.; Dr. Harvey A. Neville, Dept. of Chemistry, Lehigh University, Bethlehem, Pa.

Lectures on Wool Manufacture

WERNER VON BERGEN, chief chemist of the Forstmann Woolen Co., Passaic, N. J., and a member of U. S. Institute, has been engaged by University Extension, Columbia University, New York City, to head up a new evening course in woolen and worsted manufacture. The course consists of 15 lectures, especially designed to meet requirements of those of the trade in and near New York City, and will be illustrated with samples, lantern slides and films. The course started September 28. This is not a new rôle for Mr. Von Bergen for since 1930 he has been an instructor of various textile courses sponsored by the Forstmann Institute at the plant of the Forstmann Woolen Co.

Abstracts

This section is compiled under the direction of the Committee on Abstracts and Bibliography: Prof. E. R. Schwarz, Chairman, M. W. Weiss, Dr. Irving J. Saxl and C. H. Clark.

I. Fibres (Synthetic and Natural) and Fibre Analysis

Isolation of Cystine from Wool Hydrolyzates. Gerrit Toennies and Mary A. Bennett. *J. Biol. Chem.*, 1935, V. 112, P. 39–50; *C. A.*, 1936, V. 30, Col. 1235. (W)

Kapok Filling Material. S. Moskowitz, Wm. Landes and D. Himmelfarb. *Am. Dye. Rptr.*, April 20, 1936, P. 220–2.

(1) Adulterants of kapok for use as a filling material, can be detected by utilizing chemical stains, microscopic and fluoroscopic examinations. (2) Second-hand kapok can be distinguished from new kapok by chemical analyses for ammonia and urea. (3) Unused kapok shows an ammonia content less than 0.30%, while second-hand shows an ammonia content above 0.030%. (C)

Lignin: Chemical Nature of. Walter M. Fuchs. *Paper Trade J.*, Mar. 26, 1936, P. 33–6.

Lignin is distinguished as a characteristic constituent of plants. The evolutionary development of plants led to variations in the nature of the constituent lignin of different plants. Comments are made on the principal existing theories of lignin chemical composition and formulas are given. (C)

Mechanical Production of Artificial Fibres from Animal Flesh or Hides. (German.) A. Jaumann. *Die Kunstseide*, March, 1936, P. 109–13.

Fibres and filaments from animal flesh, hide, or leather have recently been produced on a factory scale. These fibres are commercially known in Germany as "Carnofil" or "Marena-fibres." Carnofil is a fibre which becomes more and more important in surgery because, since it consists of protein, it is completely digested by pepsin. It does not rot, and it neither gelatinizes nor changes its condition. "Carnofil" is the ideal suture material for operations for it is completely absorbed in the wound. It is produced by mechanical means from the muscles of horses or oxen after a suitable chemical treatment. Single fibres are three to eight centimeters long, the structure resembling that of flax since several of the fibres form a bundle. The so-called "Marena-fibres" are prepared from hide and

leather waste and are used like mechanical fibres in weaving. The article includes illustrations to show the use of the material. (S)

OXIDATION OF CELLULOSE AND CELLULOSE MATERIALS. H. A. Turner. *Tex. Mfr.*, April 1936, P. 150–1, 154.

A survey of the present knowledge of some of the effects of the oxidation of cellulose, which are of technical importance. (C)

PRESERVATIVES FOR RAW MATERIALS OF THE TEXTILE INDUSTRY. Justin Hausner. *Spinner u. Weber*, 1935, V. 53, P. 10–11; *C. A.*, 1936, V. 30, Col. 1568. (W)

RAW WOOL: BUYING AND SORTING—BY MEANS OF SCIENTIFICALLY SELECTED SAMPLES. Werner Von Bergen. *Rayon & Mell.*, April 1936, P. 67; *Am. W. & C. Rptr.*, May 28, 1936, P. 25–6.

A paper presented at the spring session of Committee D–13, of the American Society for Testing Materials, March, 1936, at Washington, D. C. (C)

STRUCTURE OF NATIVE COTTON CELLULOSE. H. E. Schmidt, W. Jandebeur, M. Hecker, R. Schnegg and M. Atterer. *Ber.*, 1936, V. 69, P. 366–74; *J. Soc. Dyers Col.*, April 1936, P. 152. (C)

THROWN SILK: PROCESSING OF. G. W. Searell. *Am. Dye. Rptr.*, May 4, 1936, P. 241–3.

Presented at meeting of Piedmont Section of A. A. T. C. C. Feb. 8, 1936. (C)

WOOL: NEW METHODS FOR THE TREATMENT OF—, (a Discussion of) Solvents and Non-fatty Assistants for the Washing Operation. E. Meissner. *Deut. Wollen-Gewerbe*, 1935, V. 67, P. 1433–4; *C. A.*, 1936, V. 30, Col. 1568. (W)

WOOL-LIKE ACETATE FIBRES. (GERMAN.) A. Jaumann. *Die Kunstseide*, Feb. 1936, P. 67–73.

The wool-like character of a textile yarn is expressed rather by the arrangement of the fibres in the yarn than by the particular nature of the fibres themselves. The air content—in isolated pockets—has a considerable effect upon the heat retaining qualities. Such artificial fibres of acetate origin as, for example, "Drawinella" exhibit a high heat-retaining power. The fact that the transmission of heat corresponds approximately to that found in materials of sheep's wool is due to the mutual spreading out and separation of the single fibres in the yarn. In every case spun yarns are being considered. Moistening causes the fibres to adhere, but since acetate fibres absorb moisture with greater difficulty than do other types of rayon and give off the moisture in a relatively short time, they maintain the desirable heat properties to a greater degree than the other types of artificial filaments. The temperature of ironing to be used should not exceed 170° C. The breaking extension in the wet condition for "Drawinella" is about 26%. It is stated that it is necessary—as with most artificial fibres—to avoid tensioning the yarn in the wet condition so far as possible. This par-

ticular acetate-type fibre may be dyed with acetate dyes and also some indanthrene colors, but it should be noted that the dyeing is completely resistant to rubbing and washing only in the pastel shades. It has been found that "Drawinella" has possibilities of a wide range of manufacture as indicated by a range of count from rather coarse to quite fine yarns. (S)

WOOL: POTENTIAL REDUCING PROPERTIES OF. PART I. BEHAVIOR OF WOOL IN PRESENCE OF WATER AND ALKALINE LIQUIDS. THE SULPHUR GROUPS IN WOOL. Ellis Clayton. *J. Soc. Dyers Col.*, Mar. 1936, P. 86–95.

The system wool-water yields traces of hydrogen sulphide initially on boiling vigorously in water, but in successive boiling operations with fresh water, the amount evolved diminishes until it ceases altogether. The color of the wool is degraded during the boiling operations, and it is suggested that these results are due (a) to the presence of traces of not easily accessible active sulphur groups in the wool fibre, and (b) condensation of these groups to form small amounts of complex organic sulphides with evolution of hydrogen sulphide. The reducing action of this system is of a very low order and its incidence in the industrial wet-processing of wool appears to be of little importance. A new test for the detection of active sulphur groups in wool is described and it is shown that the main sulphur linkages are attacked slightly when the fibre is boiled in mildly alkaline solutions, *e.g.*, 1% borax solution, but not by water alone. It is concluded, therefore, that –SH groups are not developed from disulphide links in the wool complex by treatment with boiling water, *i.e.*, the main sulphur linkages are comparatively stable. The gross structure of wool is discussed and the hypothesis is advanced that at least two polymeric forms of keratin are present in the complex. The results of a brief study of the action on wool of sodium hydroxide and sodium sulphide solution respectively, are indicated, while the potential reducing properties of the fibre, including the reduction of Flavanthrene R, are demonstrated by various reactions of a sodium hydroxide-wool hydrolysate. (C)

X-RAY SPECTROGRAPHY OF ALKALI CELLULOSES. J. B. Calkin. *J. Phys. Chem.*, Jan. 1936, P. 27–35.

Presented at the Twelfth Colloid Symposium, held at Ithaca, N. Y., June 20–22, 1935. Summary. 1. The X-ray data have been correlated with our previous adsorption values for cotton; 2. It has been shown that cotton treated with sodium hydroxide in ethyl alcohol solution does not form mercerized cotton; 3. Pre-treated cotton forms Na-Cell I at a lower concentration than native cotton; 4. It has not been possible to obtain Na-Cell III′ under our experimental conditions; 5. A sodium cellulosate is formed which is adsorbed by the cellulose; 6. The use of the X-ray method to supplement adsorption curves is very important and could be used very profitably." (C)

II. YARNS AND FABRICS

BETTER DRYING RESEARCH. Anon. *Rayon & Mell.*, May 1936, P. 82.

Report of U. S. Institute's recent conference on this subject. The author comments as follows: "The conference proved to this observer that our textile men are becoming more research-minded and are willing to spend more money in that direction. When it is considered what is being done in

textile research in England and Russia and the money that is spent for that purpose, we are still very far from being research-minded. It is high time that American textile men combine in such research efforts and the possibilities it offers for benefits, greater profits and knowledge.'' (C)

CELLULOSE ACETATE: MOLECULAR WEIGHT DETERMINATION FROM OSMOTIC PRESSURE. A. Dobry. *Bull. Soc. Chim.*, 1935, V. 2, P. 1882–4.

Osmotic pressure-concentration curves are given for cellulose acetate in various solvents. On extrapolation to zero concentration, the same osmotic pressure value is given by each curve, and the conclusion is reached that this limiting value affords a measure of the true molecular weight. (From *J. T. I.*, Feb. 1936, P. A84.) (C)

COTTON DRAFTING-ROLLER SETTING AND FIBRE-LENGTH VALUES. D. F. Kapadia. *Tex. Mfr.*, Mar. 1936, P. 88.

The author argues that the best roller setting on ring spinning frames has a definite relation to the super-mean value of cotton fibre length independently of other factors. In spinning medium counts there is a best speed of drafting. (C)

COTTON FABRIC TENSILE STRENGTH. Anon. *Am. W. & C. Rptr.*, April 23, 1936, P. 7–8, 28.

New relations suggested; vital facts often overlooked; advantages of interweaving and rearrangement of construction; changes add to cost but increase tensile strength. (C)

COTTON FILLING FABRIC STRENGTH. Anon. *Am. W. & C. Rptr.*, May 14, 1936, P. 9–10, 21–3.

Illustrates and describes the construction and use of a chart showing tensile strength per inch by the grab method of plain gray cloths of different picks woven from single yarns. (C)

COTTON: FLUORESCENCE. M. Déribéré. *Revue Text.*, 1935, V. 33, P. 617-22.

Inclination of the sample at an angle of 45° to the light in the examination of fibrous materials in Wood's light is recommended and observations of the fluorescence of samples of Sakel, American, Brazilian, Peruvian, African, Indian, and Egyptian cottons are discussed. The use of fluorescence effects for distinguishing between cotton and other textile fibres and between new and used cotton materials, and the study of scouring and mercerizing faults in Wood's light are also discussed and tables showing the fluorescence and ammonia, urea and sodium sulphate contents of cotton wastes and second-hand fillings are reproduced from the paper by Moskowitz, Landes and Himmelfarb. (From *J. T. I.*, Feb. 1936, P. A45.) (C)

COTTON HAIRS AND THE SPINNING QUALITY OF THE COTTONS: RELATIONSHIPS BETWEEN SOME PROPERTIES OF. C. Underwood, M. A. *Shirley Institute Memoirs*, 1935, V. 14.

The yarn property of ''Highest Standard Count'' and the hair properties of length, fineness and maturity are investigated for 371 samples of cotton ranging in type from the longest Sea Island with a staple length of nearly two inches, spun into 200s yarn, down to a short and coarse African,

spun into 10s. With smaller group of 114 Empire cottons, the lea strength and work of rupture of the yarns are examined in relation to length and irregularity of length of the hairs, hair-weight per centimeter of the long, medium and short hairs, the percentage of "normal" hairs, and the percentage of "dead" hairs. The conclusion is reached that a considerable degree of correlation exists between spinning quality and "effective length," percentage of normal hairs, and hair-weight per centimetre, but the spinning quality is influenced by hair properties other than those measured, the unknown factors being of greater moment in Empire cottons than in Egyptian cottons. As a single index from which to predict spinning quality, "effective length" is generally useful, but hair-weight per centimetre is slightly better for Empire and Egyptian cottons. The relations between the various hair properties themselves are discussed and tentative explanations of the differences found for the two groups, Empire and Egyptian, are suggested in terms of the relative effects of variety and environment. (Copied from *Interntl. Cotton Bulletin*, April 1936, P. 376.) (C)

COTTON MANUFACTURE: TECHNICAL ADVANCES IN. *Tex. Wld.*, April 1936, P. 108.

A review of new developments during 1935, including research work. Similar reviews in the same number: Woolen and worsted manufacture, P. 114; Rayon, P. 120; Silk, P. 126; Knit Goods, P. 132; Textile Processing, P. 138; Engineering, P. 142. (C)

COTTON ORGANIZATIONS: HOW TO CALCULATE DRAFTS, DOUBLINGS, SIZES, SPEEDS, WASTES, SPINDLES AND OTHER DETAILS OF. Gilbert R. Merrill. *Tex. Wld.*, 1936, May, P. 78–9; June, P. 84.

The first of a series of articles outlines the two waste spinning systems, and contains a discussion of the number of roving operations required for the regular spinning of various yarns. (C)

COTTON: SURVEY OF THE FINISHING OPERATION FOR TEXTILE GOODS MADE FROM. R. Kling. *Spinner u. Weber*, 1935, V. 53, No. 9, P. 26–8, 30–2, 34–6.

The survey covers singeing, desizing with water, enzymes, alkalies or acids and with oxidizing agents, boiling in lye, bleaching, mercerization, starching, fulling, drying and stretching. (From *C. A.*, 1936, V. 30, Col. 1569.) (W)

COTTON WARP FABRIC TENSILE STRENGTH. Anon. *Am. W. & C. Rptr.*, April 30, 1936, P. 5–6, 13–14.

Chart for determination shown and application explained; some comments on accuracy of skein method; factors affecting warp strength; use of standard grab method. (C)

COTTON WARP SIZING: NOTES ON. Ralph Hart. *Am. Dye. Rptr.*, 1936, May 4, P. 231–6, 250–1; May 18, P. 258–60, 282–6; *Am. W. & C. Rptr.*, 1936, May 7, P. 19–21; May 14, P. 11–12, 38; May 21, P. 23–4, 39; May 28, P. 9–10, 14–15; *Rayon & Mell.*, May 1936, P. 69–71.

A comprehensive and valuable review of the properties of materials used in cotton-warp sizing, their application, effect and the machinery of sizing,

based upon literature of the subject accumulated by the author. It includes both basic and practical data. and its value is due quite as much to the manner in which it has been selected and interpreted, as to the authoritativeness of the source material. It is admitted by the writer that certain of the matter is actually or apparently contradictory. He also notes inability to provide a detailed list of references. This is particularly unfortunate in the case of what purports to be new basic and technical data. (C)

COTTON-YARN TESTING AS AN INDICATION OF WEARING QUALITIES. David Atkinson. *Tex. Bull.*, 1935, V. 49, No. 14, P. 5–6.

Physical tests are discussed. (From *C. A.*, 1936, V. 30, Col. 1569.) (W)

CYLINDER SPEEDS: EFFECTS OF DIFFERENT—ON CARD WASTES, SLIVER AND YARN. Horace Spibey. *J. T. I.*, Mar. 1936, P. T88–100.

This research, undertaken to determine the effects of different cylinder speeds on: (a) waste extraction at the various parts of the card, and (b) sliver and yarn properties, was conducted with Good Sakellaridis Egyptian and Strict Middling Texas American cottons respectively. The mean and most frequent lengths of the Egyptian were 27.2 mm. and 36.0 mm., and of the American 23.5 mm. and 24.5 mm.

The only variable throughout the investigation was the speed of the cylinder, seven speeds being chosen to give uniform increases within the limits of 135 and 225 r.p.m. The wastes and sliver made during equal periods of carding at each cylinder speed were collected, weighed and analyzed. After testing for regularity the Egyptian slivers were spun into 60s ring twist, and the American slivers into 30s ring twist, each set of yarns being tested and compared for strength, regularity, hairiness, neppiness, and cleanliness.

The results of the investigations may be summarized as follows: (1) The lower and upper limits to cylinder speed for the Egyptian cotton are approximately 135 and 210 r.p.m. and for the American 135 and 225 r.p.m. The lower limit is indicated by cloudiness of the flat strips and card web, the upper limit by neppiness and cloudiness of the web in the case of the Egyptian cotton, and by cloudiness of the web only in the case of the American. (2) Raising the cylinder speed increases the amount of taker-in waste, flat strip, doffer strip and cylinder undercasing fly, but decreases the amount of cylinder strip in a less degree so that on balance the total waste increases slightly. (3) The strongest Egyptian yarns are produced at speeds of approximately 165 to 195 r.p.m. and the most regular but least hairy yarns at speeds of approximately 150 to 195 r.p.m. At high (210 and 225 r.p.m.) and low (135 r.p.m.) speeds the yarns are equally irregular and hairy but the high-speed yarns are neppy and stronger. The yarns are equally clean at all speeds.

The strengths of the American yarns increase from the lowest to the highest speed. The most irregular yarn is produced at the lowest cylinder speed; at all other speeds the yarn irregularity is unchanged. Changes in the cylinder speed do not affect the cleanliness and hairiness of the yarns. (C)

DAMAGE TO FIBRES BY FIRE-PROOFING AGENTS. (GERMAN.) Hans-Joachim Henk. *Die Kunstseide,* Feb. 1936, P. 45–6.

The sensitivity of artificial silk toward acid requires careful selection and examination of the materials used for fire-proofing. Damage to the fibre is caused in particular by such compounds as aluminum, ammonium, magnesium sulphate, and ammonia alum which split off sulphuric acid at high temperatures; that is, during ironing. Damage by ammonium phosphate, zinc chloride, boric acid, and sodium borate was also ascertained. Attention should be paid to the possible presence of impurities in the impregnating agents—particularly iron compound which may be the cause of catalytic destruction of the color and of the fibre. Fire-proofing impregnating agents of good and lasting action, which neither attack the color nor the fibre, are obtained by the use of sodium tungstate, sodium vanadate, sodium stannate, and ammonium bromide. (S)

DEFECTS AND SOURCES OF DEFECTS (IN TEXTILES), WHERE THEY ARE AND HOW TO RECOGNIZE AND AVOID THEM. Güni. *Deut. Wollen-Gewerbe,* 1935, V. 67. P. 899–901; *C. A.,* 1936, V. 30, Col. 1568. (W)

DRYING OF SCOURED WOOL. E. N. Angus. *Tex. Rsch.,* June 1936, P. 360–3; *Am. W. & C. Rptr.,* May 28, 1936, P. 26, 30.

Paper read at recent conference on drying problems held under auspices of U. S. Institute for Textile Research in New York City, May 6. (C)

EGYPTIAN COTTON VS. RAYON STAPLE FIBRE. *Interntl. Cotton Bulletin,* April 1936, P. 318–20. (C)

FAULTS IN RAYON FABRICS. J. M. Preston. *Tex. Mfr.* (*Rayon Supplement*), 1936, May, P. XLV; June, P. 213–4; Aug., P. 302–3.

A method of analysis and some types of faults are discussed. (C)

FELTING OPERATION. W. Haussner. *Spinner u. Weber,* 1935, V. 53, No. 2, P. 8–10.

A review covering the use of fats, soaps and acids and discussing various causes of defects. (From *C. A.,* 1936, V. 30, Col. 1570.) (W)

III. CHEMICAL AND OTHER PROCESSING (NOT OTHERWISE CLASSIFIED)

ABSORPTION OF DYESTUFFS BY CELLULOSE. VI. EFFECT OF MODIFICATION OF THE CELLULOSE, AND A THEORY OF THE ELECTROLYTE EFFECT. J. Hanson, S. M. Neale and W. A. Stringfellow. *Trans. Faraday Soc.,* 1935, V. 31, P. 1718–30; *C. A.,* 1935, V. 29, Col. 347; 1936, V. 30, Col. 1566. (W)

ALKALI DEGRADATION OF WOOL PROTEIN: MECHANISM OF SULFUR LABILITY IN THE. J. A. Crowder and Milton Harris. *Am. Dye. Rptr.,* May 18, 1936, P. 264–6; *B. S. J. Rsch.,* May 1936, P. 475–80.

The authors are research associates of the A. A. T. C. C., working at the National Bureau of Standards. In this paper they describe the be-

havior of sulfur in wool under conditions which are very different from those ordinarily used in studies on sulfur lability and point out a probable mechanism by which sulfur is split from wool during alkaline treatment. The data indicate that the primary process in the alkaline cleavage of the disulfide linkage consists of a hydrolytic rupture of the disulfide group with the formation of a sulfydryl compound and a sulfenic acid. The sulfenic acid is extremely reactive and unstable in alkaline solution and immediately loses hydrogen sulfide and forms an aldehyde. The results of the investigation indicate that the existence of labile-sulfur in proteins is not an indication that the bulk of the sulfur is present in more than one form. (C)

ALKALINE BOILING: SUPPRESSION OF—IN THE BLEACHING AND DYEING OF VEGETABLE FABRICS. Raymond Vidal. *Rev. gen. mat. color.*, 1935, V. 39, xlvii–xlviii.

Use of NaOCl plus a fatty acid gives a stronger and more elastic fabric. It suffices to have a simple passage of the fabric through a cold bath of 0.5% detergent acid for one to two min., to hydrophilize the fabric, and thus suppress the 8 to 12 hours' operation of alk. boiling. (From *C. A.*, 1936, V. 30, Col. 1235.) (W)

AZO DYES: ANALYSIS OF—WITH HYPOSULPHITE. V. I. Minaev and V. N. Kilel'nikov. *Trans. Inst. Chem. Tech. Ivanovo* (U. S. S. R.), 1935, V. 1, P. 59–65; cf. *C. A.*, V. 26, P. 1543; V. 27, P. 4084; V. 30, Col. 867. (W)

AZO DYES: INFLUENCE OF POSITION ISOMERISM (STRUCTURAL DIFFERENCES) IN—ON THEIR FASTNESS TO LIGHT AND WASHING. Marion E. Griffith. Ohio Agr. Expt. Sta., *Bull.* No. 548 (*53d annual report*), 1935, P. 80–1; *C. A.*, 1934, V. 28, Col. 7021; 1936, V. 30, Col. 1565. (W)

AZOIC DYES: APPLICATION OF—TO TEXTILES. H. Blackshaw. *J. Soc. Dyers Col.*, April 1936, P. 135.

Elucidates practical dyeing problems in connection with the application of azoic dyes to textiles. (C)

BLEACHED FABRICS THAT TURN YELLOWISH, SPOTTY AND STREAKY, WITH PARTICULAR REFERENCE TO SURGICAL, BALE, PADDING AND ABSORBENT COTTON. H. Rehmann. *Monatschr. Textil-Ind.*, 1935, V. 50, P. 265–6; *C. A.* 1936, V. 30, Col. 1569. (W)

BLEACHING PROPERTIES OF SODIUM HYPOCHLORITE: RATIONAL UTILIZATION OF THE. V. I. Minaev. *Trans. Inst. Chem. Tech. Ivanovo* (U. S. S. R.), 1935, V. 1, P. 174–80; cf. Minaev, *et al.*, *Monatschr. Textil-Ind.*, 1929, V. 44, Nos. 2, 3; *C. A.*, 1936, V. 30, Col. 869. (W)

CALGONIZING: WHAT IS MEANT BY—? Anton Volz. *Z. ges. Textil-Ind.*, 1935, V. 38, P. 563–4.

To calgonize means to treat a textile fabric with Calgon in order to obtain certain improvements of the quality. Calgon increases the absorptive capacity of the fabric and gives it a better feel and color. Calgon is not

suitable for general water softening purposes as the well-known softening methods are more economical. It is used to neutralize residual hardness formers in softened waters and to prevent the formation of ppts. in various baths at any temp. and without any app. (From *C. A.*, 1936, V. 30, Col. 1570.) (W)

CELLULOSE ACETATE RAYON: TREATMENT TO INCREASE RESISTANCE TO BOILING. Société Aceta. *L'Ind. Text.*, 1935, V. 52, P. 523.

The resistance of cellulose acetate rayon to boiling aqueous baths can be considerably improved by replacing soaps and alkali salts of sulphonated fatty alcohols, oils and similar products in the preparations used in the treatment of the rayon by salts of aliphatic amines or of quaternary ammonium compounds containing more than eight carbon atoms in the molecule. Examples of suitable mixtures for the treatment of rayon threads are given. (From *J. T. I.*, Feb. 1936, P. A65.) (C)

CHEMICAL CONSTITUTION AND COLOR: RELATION BETWEEN. Moses L. Crossley. *Am. Dye. Rptr.*, May 4, 1936, P. 251.

Some of the factors that influence the capacity of a dye to color materials are given and their action explained. (C)

DEGRADATION OF COLORS UNDER THE INFLUENCE OF LIGHT AS A FUNCTION OF CONCENTRATION. J. Pinte. *Chambre Commerce Rubaix Lab. recherches ind.*, 1935, No. 25, P. 10–23; *Chim. et ind.*, V. 34, P. 923; cf. *C. A.*, 1934, V. 28, Col. 5989; 1936, V. 30, Col. 1233. (W)

DYEING ACETATE COTTON UNIONS, WITH SPECIAL REFERENCE TO MERCERIZED FABRICS. R. H. Bourdon. *Silk J.*, 1935, V. 12, No. 137, P. 32–3.

Various operations are cited to overcome different difficulties in the processing of mercerized cotton and acetate rayon. (From *C. A.*, 1936, V. 30, Col. 868.) (W)

DYEING OF WOOL. R. Haller. *Helv. Chim. Acta*, 1936, V. 19, P. 15–22.

The dyeing of wool depends largely on the state of swelling of the fibre. Scarcely any dyeing occurs in the cold or on short heating, but microscopic examination of wool, after boiling, *e.g.*, 10 min. in the dye solution, reveals the presence of dye in the cortical layer. The epidermis is completely intact, so that the dye must have either penetrated the scales or some of the "packing material" occurring between the epidermis and the cortical layer, has been dissolved and so facilitated penetration of the dye within the fibre. Presence in the dyebath of a substance of unknown constitution has been detected by the biuret reaction, and this is more probably the above "packing material" than the cementing substance occurring between the scales, which is only soluble in alkaline liquors. (From *J. Soc. Dyers Col.*, April 1936, P. 156.) (C)

DYES: BEHAVIOR OF ARTIFICIAL TEXTILE FABRICS WITH RESPECT TO. Herbert Brandenburger. *Monatschr. Textil-Ind.*, Nov. 1935, P. 90–2; *C. A.*, 1936, V. 30, Col. 1566. (W)

DYES: A NEW GROUP OF. George Rudolph. *Z. ges. Textil-Ind.*, 1936, V. 39, P. 24–5; *C. A.*, 1936, V. 30, Col. 1565. (W)

DYES: PRECISION IN THE ANALYSIS OF. M. G. Martin. *Rev. gén. mat. color.*, 1935, V. 39, P. 423–8; *C. A.*, 1936, V. 30, Col. 1233.

The use of math. formulas as an aid is given. (W)

EMULSIONS: RECENT INVESTIGATIONS ON—WITH SPECIAL EMPHASIS ON THE MECHANICS OF FORMATION. W. Clayton. *Ind. Chem.*, 1936, V. 12, P. 15–16; *J. Soc. Dyers Col.*, April 1936, P. 147. (C)

FABRICS: PARTIALLY SUBSTANTIVIZED ACETATE RAYON AND ITS UTILIZATION FOR THE PRODUCTION OF VARIOUS EFFECTS IN. E. Wagner and Paul-August Koch. *Z. ges. Textil-Ind.*, 1936, V. 39, P. 18–22.

A cellulose fabric can be dyed in either of two ways both of which depend on the fact that partly or completely esterified cellulose is affected differently by dyes than is pure or hydrated cellulose. (From *C. A.*, 1936, V. 30, Col. 1568.) (W)

FADING OF DYESTUFFS. I. PHOTOCHEMICAL DECOMPOSITION OF MALACHITE GREEN AND CRYSTAL VIOLET. K. Iwamoto. *Bull. Chem. Soc. Japan*, 1935, V. 10, P. 420–5; *C. A.*, 1936, V. 30, Col. 1235. (W)

FASTNESS OF COTTON DYEINGS. Dr. Schwen. *Tex. Mfr.*, April 1936, P. 153–4.

Various aspects of fastness in dyestuffs, and application and possibilities in the use of after-treatment process and substances. (C)

GELATIN SOLS: STRUCTURE VISCOSITY. N. Peskoff and S. Averbuch. *Kolloid Z.*, 1935, V. 73, P. 182–91.

A description is given of a viscometer for the investigation of lyophilic sols. Deviations from the Hagen-Poiseuille law in gelatin sols are conditioned by two factors, the internal structure and the orientation of the particles. Addition of acid and alkali increases the viscosity and reduces the elastic counter-force. The absolute value (η) of the viscosity appears to be not unconditionally related to structure phenomena, for sols at a pH remote from 4.5 show a greater viscosity, although the structure is less marked. In consequence the authors propose the expression "anomalous viscosity" instead of "structure viscosity," retaining the latter for special cases only. The deviations from the Hagen-Poiseuille law disappear in 2% electro-dialyzed gelatin sols at 34° C, this temperature being reduced to 30° C outside the pH region 3.5–5.5. (From *J. T. I.*, Mar. 1936, P. A142.) (C)

GELATIN, STARCH AND SYNTHETIC RESINS: STRUCTURE VISCOSITY. J. Coumou. *Chem. Weekblad*, 1935, V. 32, P. 426–9 (through *Brit. Chem. Abs.*, 1935, P. A1074).

Solutions of gelatin, starch (if not heated for too long a period), dextrin, carobin, gum tragacanth, linseed, and pectin in water, lichenin in dilute alkali, and polystyrene in tetrahydronaphthalene show structure viscosity (change in η with rate of flow). Solutions of sucrose, glucose, gum arabic,

and gum acajou in water and of phenol- and cresol-formaldehyde resins in acetone or alcohol do not show this effect. The difference is attributed to the long-chain structure of the former and relatively compact form of the molecules of the latter. (From *J. T. I.*, Mar. 1936, P. A143.) (C)

HOT-AIR DRYING MACHINES AND OXIDATION MACHINES. THEIR IMPORTANCE TODAY FOR THE PRINTER AND DYER. Richard Golbs. *Z. ges. Textil-Ind.*, 1935, V. 38, P. 576–7, 588–9; *C. A.*, 1936, V. 30, Col. 1571. (W)

IMPREGNATION TECHNIC (FOR TEXTILES). Fritz Ohl. *Spinner u. Weber*, 1935, V. 53, No. 15, P. 8–13.

A crit. review of com. prepns. and suggested methods for waterproofing textile fabrics. (From *C. A.*, 1936, V. 30, Col. 1570.) (W)

INDIGOID DYES. Sisir Kumar Guha. *J. Indian Chem. Soc.*, 1935, V. 12, P. 659–64; *C. A.*, 1934, V. 28, Col. 6315; 1936, V. 30, Col. 1565. (W)

NEW OIL FOR OLD LAMPS. J. M. F. Leaper. *Am. Dye. Rptr.*, April 20, 1936, P. 223.

A survey of possible applications by silk throwsters of newly discovered chemical products. (C)

OXYGEN BLEACHING FOR VISCOSE AND VISCOSE-MIXED WEAVES. Fritz Ohl. *Mell. Textilber.*, 1934, V. 15, P. 555; *Am. Dye. Rptr.*, April 6, 1936, P. 170.

A very closely reasoned discussion of the whole subject, obviously, from the title, in favor of the oxygen bleach. (C)

PHOSPHATES: USES OF—IN THE WOOLEN AND WORSTED INDUSTRIES. VALUE OF SODIUM METAPHOSPHATE. F. Hall. *Tex. Col.*, April 1936, P. 262–3, 275. (C)

PREVENTION OF THE PRECIPITATION OF LIME BY MEANS OF CALGON. C. Steiner. *Spinner u. Weber*, 1935, V. 53, No. 39, P. 13–4.

Calgon ($NaPO_3$) prevents the pptn. of insol. soaps by formation of sol. complex Ca and Mg salts. (From *C. A.*, 1936, V. 30, Col. 1570.) (W)

PRINTING PLUSH AND VELOURS OF RAYON. F. Weber Schultze. *Rev. gen. mat. color.*, 1935, V. 39, P. 385–8.

Complete formulas for printing are given. Plush and velours are printed in a similar manner. Velours of regenerated cellulose are more fragile than those of acetate. Vat colors are used for acetates and direct colors for viscose. (From *C. A.*, 1936, V. 30, Col. 868, 2389.) (W)

RAYON: FIREPROOFING. F. R. Urban. *Kunstseide*, 1935, V. 17, P. 440–3.

Various methods of fireproofing rayon are briefly described, with recipes. (From *J. T. I.*, Feb. 1936, P. A67.) (C)

RAYON: NEW CHEMICAL METHODS IN PROCESSING. L. G. Lawrie. *Tex. Mfr.* (*Rayon Supplement*), May 1936, P. XXV.

Textile chemical assistants or auxiliary products which are available to assist softening, scouring, dyeing, finishing or waterproofing rayon. (C)

SILK AND RAYON FABRICS: PROBLEMS INVOLVED IN FINISHING HEAVY-WEIGHT. Dwight L. Johnson. *Am. Dye. Rptr.*, Apr. 6, 1936, P. 174–9.

Discusses those phases of manufacture over which the dyer has no control, and the difficulties that develop in boil-off, scouring, dyeing and finishing operations—processes over which the dyer has a very definite control. (C)

SILK: DEGUMMING WITH PAPAIN. H. Münch. *Textilber.*, 1935, V. 16, P. 871–4.

The usual soap degumming process has an injurious action on cellulose acetate rayon and wool. Silk in combination with these other textile fibres can be satisfactorily degummed by the use of papain in the presence of suitable activators. Tests have shown that the most suitable activators are sodium thiosulphate for silk-wool mixtures and a mixture of sodium thiosulphate and sodium hydrosulphite for silk-cellulose acetate rayon mixtures. The conditions of treatment are described. (From *J. T. I.*, Mar. 1936, P. A117.) (C)

SILK: WEIGHTING. *Tex. Merc.*, 1936, V. 94, P. 28A–9.

It is claimed that in the weighting of silk the replacement of stannic chloride by zinc acetate, after two treatments with stannic chloride and disodium phosphate, increases the durability of the silk, and reduces the number of treatments necessary to achieve a certain increase in weight. The addition of sodium silicate, together with an ammoniacal solution of zinc acetate, is also recommended. (From *J. T. I.*, Mar. 1936, P. A117.) (C)

SOAP: IS—COMING INTO ITS OWN AGAIN? Anton Volz. *Monatschr. Textil-Ind.*, Nov. 1935, P. 93–4.

A literature review shows that the action of soap is important for numerous textile purposes and that soap cannot be entirely displaced by Ca-resistant detergents. This is particularly true for the degumming of natural silk, the dissolving of linseed oil size, the alk. felting of wool and a variety of washing operations in the textile industry. (From *C. A.*, 1936, V. 30, Col. 1571.) (W)

SOAP-SODA SOLUTIONS: THEIR INFLUENCE ON COTTON AND LINEN FABRICS AT VARIOUS CONCENTRATIONS AND TEMPERATURES. I. R. Smit. *Textilber.*, 1935, V. 16, P. 879–80; 1936, V. 17, P. 64–6.

The injurious action of soap and soda on the fabrics is as great at 75–80° C. as it is at 95–100° C. Oxygen from the air has no harmful effect in washing treatment. Cotton is practically unattacked by soda-soap solutions, and the decrease in strength of linen after treatment with soda solutions is nearly the same at concentrations of 5, 10, 15 and 20 g. per l. (From *J. T. I.*, Mar. 1936, P. A117.) (C)

SPRAY DYEING OF SILK AND RAYON FABRICS. R. C. Caystor. *Deut. Wollen-Gewerbe*, 1935, V. 67, P. 1465; *C. A.*, 1936, V. 30, Col. 1566. (W)

STRIPPING AND DYEING OF RECLAIMED WOOL. H. Feld. *Monatschr. Textil-Ind.*, 1935, V. 50, P. 266–7; *C. A.*, 1936, V. 30, Col. 1567. (W)

SULPHONATED OZONIZED OIL SIZES. *Wool Rec.*, 1935, V. 48, P. 1461–3.

The advantages and disadvantages are stated of sulphonated ionized oil sizes for use in the processing of rayon and rayon-wool mixture cloths. (From *J. T. I.*, Feb. 1936, P. A56.) (C)

SULFONATED (SULFATED) OILS: COMMERCIAL GRADING OF. Ralph Hart, Chm. of Sub-committee on Sulfonated Oils of A. A. T. C. C. Report No. 5. *Am. Dye. Rptr.*, Mar. 9, 1936, P. 122. (C)

SULFONATED (SULFATED) OILS AND OTHER PRODUCTS OF THIS INDUSTRY. *Tex. Col.*, Mar. 1935, P. 161–7.

Reprint of the "Handbook of Data relating to Sulfonated (Sulfated) Oils and Other Products of this Industry," published by the Sulphonated Oil Manufacturers Assoc. (C)

SURFACE CHEMISTRY AND DYEING. H. A. Neville. *Am. Dye. Rptr.*, May 18, 1936, P. 267–78.

Describes the principles of surface chemistry which apply in dyeing and mordanting, and also in the wetting-out process. Discussion of the paper is also published. (C)

SURFACE TENSION EFFECT: IGEPON T AND A AND GARDINOL WA. W. Weltzien and H. Ottensmeyer. *Monatsh. Seide u. Kunstseide*, 1935, V. 40, P. 504–7; *J. T. I.*, Mar. 1936, P. A116. (C)

IV. RESEARCH METHODS AND APPARATUS

CALCULATION OF THE CONCENTRATION AND DISSOCIATION CONSTANT OF EACH ACID GROUP IN A MIXTURE FROM pH TITRATION CURVE OF THE MIXTURE. J. O. Burton and S. F. Acree. *B. S. J. Esch.*, June, 1936, P. 525–28.

Experimental methods and equations are given for calculating the concentration and dissociation constant of each acid or base in a mixture by use of its complex pH titration curve. The principle is illustrated by means of experimental data for malonic acid. This problem is important as an aid in determining the nature of the acids and bases in plant and animal fibres, and products derived from them. (C)

CAMERA MICROSCOPES: APPLICATION. A. B. Carsten. *Kunstseide*, 1936, V. 18, P. 7–10.

Recent improvements in photomicroscopes are discussed and the chief features and innovations in the MeF Universal camera microscope are described. This instrument is easily adjusted for either visual observations or photographic work. The Universal Opak, the Epilum and the Abbe illuminating devices for use with the microscope are briefly described. (From *J. T. I.*, April 1936, P. A178.) (C)

CELLULOSE IN FIBROUS RAW MATERIALS: DETERMINATION OF. E. Debenedetti and F. Pancirolli. *Ind. carta*, 1935, V. 13, P. 289–96; *Chim. & Ind.*, V. 35, P. 398; *C. A.*, 1936, V. 30, Col. 3631. (W)

CELLULOSE: METHODS OF DETERMINING—IN BAST PLANTS. F. Kalmanovitch and A. F. Kolotireva. *Rayon & Mell.*, June 1936, P. 75–7.

Comparison of Cross-Bevan's and Kiesel-Semiganovsky's methods. (C)

COTTON HAIRS: DEVICE FOR MOUNTING—FOR EXAMINATION OF FIBRE-MATURITY. Nazir Ahmad and A. N. Gulati. *J. T. I.*, April 1936, P. T109–11. (C)

CROCK TESTING AND RECORDING MACHINE. *Am. Dye. Rptr.*, June 15, 1936, P. 331.

This machine, which has been accepted as the standard for the A. A. T. C. C. by the Research Committee, has a round finger of diameter five-eighths of an inch, length of stroke four inches, and a force on the crocking finger of two pounds. Unsized white cotton cloth is specified for the tests. (The Committee tentatively suggests 20 double strokes as the most useful for comparison tests between dyer, chemist, agent, and buyer.) (C)

COEFFICIENT OF FRICTION FOR YARNS. Irving J. Saxl. *J. Franklin Institute*, June 1936, P. 789–96.

Describes an instrument and a method by which it is possible to determine the coefficient of friction of individual yarns in absolute figures. It consists substantially in paralyzing the constant, rotary movement of an unbalanced wheel by the frictional resistance of a piece of yarn, loaded at each end with a definite weight. The yarn is in contact with one-half of the carefully standardized surface of the rim of the wheel. The mathematical analysis of the physical principle involved is given. The method described lends itself also to the investigation of the frictional characteristics of different weaving and knitting constructions, to the determination of the lubricating value of different throwing oil compounds and various oils, the influence of oxidation upon the lubricating value of oils, the change in the friction of yarns imparted to them by sizes and other agents. The coefficients of friction for several different types of yarns and conditioned yarns have been tabulated, and the following are specifically noted: (1) The coefficient of friction for synthetic yarn is comparatively low. A μ of 0.126 as is the case with viscose type yarn is only a fraction compared to the friction of leather on dry metals with a μ of about 0.56; (2) the coefficient of friction in spun yarns is particularly low. This is one of the reasons why it is often possible to weave rayon staple without slashing; (3) conditioning reduces yarn friction; (4) the friction af acetate type yarns is generally higher than the friction of viscose type yarns. (C)

CUPRAMMONIUM CELLULOSE SOLUTION: VISCOSITY DETERMINATION. K. Fabel. *Kunstseide*, 1936, V. 18, P. 5–7.

The author describes in detail a rapid method for the determination of the viscosity of cellulose in cuprammonium solution. An Ostwald viscometer is used and complete exclusion of air during the determination is not essential. The time required varies from 20 min. to one hour. When a suitable correction is applied the difference between the results obtained by this rapid method and those given by the Ost method are not great. The rapid method is useful for the testing of linters and cellulose raw materials

and for control purposes in bleaching processes. (From *J. T. I.*, April 1936, P. A179.) (C)

ELECTRICAL ORIENTATION OF WOOL CELLS. H. J. Woods. *Proc. Leeds Phil. and Literary Soc.*, 1935, V. 3, P. 132–34.

A method of obtaining films of oriented wool cells by sedimentation from an aqueous suspension in an alternating electric field is described. Using these films an X-ray fibre photograph is obtained which is identical with that of normal *a*-keratin in the untreated fibres. (From *J. T. I.*, April 1936, P. A180.) (C)

INSULATION TEXTILES: ELECTRICAL RESISTANCE TESTS. J. Van Laethem and R. Vernimmen. *Instr.*, 1935, V. 8, P. 333–4.

Experiments on cotton and silk showed that measurement of the electrical resistance of an aqueous extract of the material affords a measure of the insulation properties of the material. The determination of minimum resistance requirements is described. (From *J. T. I.*, Mar. 1936, P. A134.) (C)

MACHINERY: INFLUENCE OF MILL AND SHOP TESTS ON DEVELOPMENT OF NEW. Robert J. McConnell. *Cotton*, May, 1936, P. 82–3; *Tex. Bull.*, Apr. 30, 1936, P. 3–4, 34.

Abstract of a talk presented before the Eastern Carolina Div. of the Southern Textile Association at Raleigh, N. C., April 25. The author is superintendent of service at the Whitin Machine Works. (C)

MERCERIZATION: METHODS FOR THE DETERMINATION OF THE DEGREE OF. Karin Schulze. *Monatsh. Seide Kunstseide*, 1935, V. 40, P. 472–8.

Numerous chem. and phys. methods are briefly described and references are given. (From *C. A.*, 1936, V. 30, Col. 1570.) (W)

MERCERIZATION: TEST FOR—IN THE PRESENCE OF DYES. Sidney M. Edelstein. *Am. Dye. Rptr.*, April 6, 1936, P. 186–90.

The work shows that the modified barium hydroxide absorption method is suitable for determining whether a sample of cotton has been mercerized and that it also offers an indication of the activity of the mercerized cotton. The determination is easy to carry out and the physical form of the samples or the presence of dyes on the samples do not interfere with the test. The variables of temperature, barium hydroxide concentration and time of standing (above two hours) do not affect the results of the test. (C)

MICROSCOPY AND PHOTOMICROGRAPHY IN THE TEXTILE LABORATORY WITH "PANPHOT." (GERMAN.) Dr. Hugo Freund. *Die Kunstseide*, Mar. 1936, P. 85–9.

The author describes the new microscope which meets many of the requirements for textile work. It is a rather new arrangement of the instrument which can be readily used for drawing, direct observation, or photomicrography interchangeably. The instrument was developed from the well-known rayon spinneret inspection device. Owing to its more or less universal character, the microscope is of considerable value where only

one instrument is possible and meets the need of a laboratory which does not want to invest in a number of different types of microscope for varying purposes. (S)

PAULSEN PSYCHROMETER. *Textilber.*, 1935, V. 16, P. 880.

The Paulsen psychrometer works on the usual wet and dry bulb principle but is provided with a novel reading device which permits the relative humidity to be read off without the use of separate tables or curves. A mark on the reading device is adjusted to the dry bulb temperature and the temperature difference read on a vernier. A drum is then turned until this difference number appears at the top and the relative humidity figure appears at an opening in the reading device. (From *J. T. I.*, Mar. 1936, P. A139.) (C)

PHOTO-ELECTRIC CELL ADAPTED TO RAW SILK GRADING. *Tex. Wld.*, Apr. 1936, P. 126.

Describes the Evenometer developed by the United States Testing Co., Hoboken, N. J. (C)

STAPLE RAYON: SEVERAL NEW TESTING DEVICES FOR. H. J. Henning. *Monatsch. Seide Kunstseide*, 1936, V. 41, P. 45–50; *C. A.*, 1936, V. 30, Col. 3652. (W)

STARCH PASTES: CONSISTENCY CHANGES. G. V. Caesar and E. E. Moore. *Ind. Eng. Chem.*, 1935, V. 27, P. 1447–51.

A description is given of an improved consistometer for studying the pasting phenomena of starches. The degree of degeneration of a starch is revealed by the form of the curves, when paste temperature is plotted against the net power in watts required to maintain a constant speed of agitation. Charts are shown giving the consistency record of pastes of tapioca flour, heavy- and thin-boiling corn, potato, and wheat starches. (From *J. T. I.*, Mar. 1936, P. A143.) (C)

VOLUMETRIC METHOD FOR DISTINGUISHING BETWEEN ACTIVE CHLORINE OF HYPOCHLORITE AND COTTON CHLORAMINES IN USED BLEACHING BATHS. E. Kornreich. *Mell. Textilber.*, 1936, V. 17, P. 227–8.

Procedure is described for the determination of active chlorine in used bleaching liquors, as distinct from the chlorine combined with the cotton albumens as chloramines. The procedure is based on the facts that the chloramines do not react with hydrogen peroxide, whilst hypochlorite is completely destroyed by it, and that Methyl Orange is decolorized immediately by hypochlorites, but only after prolonged action of the chloramines. (Copied from *J. Soc. Dyers Col.*, May 1936, P. 196.) (C)

WOOL: DETERMINATION OF—IN WOOL-COTTON TEXTILE MATERIALS. Bertil A. Ryberg. *Am. Dye. Rptr.*, June 1, 1936, P. 296–302; *Am. W. & C. Rptr.*, July 23, 1936, P. 9–10, 39.

Conclusions: (1) An improved method for the determination of wool in wool-cotton textile materials by the use of sulfuric acid has been developed and reported; (2) the Kjeldahl method for determining the nitrogen content of wool as a means for estimating the amount of wool in wool-cotton

textile materials was found to be less reliable for routine work than the sulfuric acid method herein described. This paper is concerned with the analysis of wool-cotton materials, but preliminary observations as to the effect of the recommended procedure on the other fibres give the following indications: Silk: Completely dissolves. Tussah Silks: The tussah fibre appears to dissolve completely, leaving a very small residue of woody, non-fibrous material. Regenerated Cellulose Rayon: Completely dissolves. Acetate Rayon: Completely dissolves. (C)

V. Economics, Physics and Miscellany

Theorem of Singularity for Limiting Problems in the Theory of Elasticity. A. S. Bakaliajev. *Comptes Rendus (Doklady) de l'Acad. des Sciences, U. S. S. R.*, V. 1, P. 2, 1936. (In French.)

A closed surface is considered and the limits for the exterior region of this surface are dealt with. The wave equations for the theory of elasticity are stated and the singularity of the solution proved. (X)

X-ray Study of Amorphous Rubber. G. L. Simard and B. E. Warren. *Am. Chem. Soc. J.*, March 1936, P. 58.

The density of surrounding atoms in unstretched rubber is determined by a Fourier analysis of the X-ray scattering curve. The resulting distribution curve is in good agreement with the usual picture of rubber as comprised of long chain molecules. It is concluded that but little information can be obtained as to the configuration of the chains in unstretched rubber. (X)

Equilibrium and Elastic Stability of a Thin Twisted Strip. A. E. Green. *Roy. Soc. Proc.*, April 1936, P. 154A.

A twist can be produced in a flat rectangular bar or thin strip which is much larger than that allowed for by the first order, or St. Venant, theory; and consequently, the usual linear relation between the couple and the twist is no longer true. A formula for the couple is found which includes a second-order term depending on the cube of the twist. This term arises from the extension or contraction of linear elements, which in the unstrained state are parallel to the length of the strip. The formula agrees fairly well with experiments, but, at a well-defined value of the twist, the strip became unstable. A theoretical investigation is made into the elastic stability of a thin twisted strip and it is found that the strip does become unstable at a definite value of the twist, which is slightly greater than that observed. This difference is probably due to lack of straightness in the strip. For steel the instability occurs when the couple reaches 1–43 times the St. Venant couple. This result is independent of the ratio thickness/width. Two different strips of steel have been used in the experiments. The results are represented on separate graphs for each strip, and also in a non-dimensional form on one graph. (X)

Surface Tension Measurements of Viscous Liquids. A. H. Pfund and E. W. Greenfield. *Ind. & Eng. Chem.* (*Anal.* Ed.), March 15, 1936.

A small air jet impinging perpendicularly on the surface of a liquid produces a small stable depression whose depth, a, is measured by a hori-

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A small air jet impinging perpendicularly on the surface of a liquid produces a small stable depression whose depth, a, is measured by a hori-

zontal short-focus telescope. Measurements with water, glycerol, glycol, dibutyl phtalate and two oils gave the empirical relation $T = Ka$ where K is a constant for a given jet, air pressure, and distance between the jet and the undisturbed surface. This method can be used for determining T and is particularly applicable to viscous liquids which cannot be dealth with satisfactorily by most other methods. It is suggested that interfacial tensions could conveniently be measured in the same way. The air jets are sensitive to short sound waves and this effect is well adapted for demonstration. (X)

Book Reviews

COLLOID CHEMISTRY OF CELLULOSIC MATERIALS. Alfred J. Stamm. Miscellaneous Publication No. 240 of U. S. Dept. of Agriculture. 90 pp. Price 10c. Superintendent of Documents, Washington, D. C.

In an effort to stimulate further researches, and a clearer knowledge of cellulosic materials and their chemical and physical relationships, the Forest Products Laboratory of the U. S. Department of Agriculture, of which the author is senior chemist, division of research, has performed a valuable service in making available this review. It is admittedly an incomplete review of the subject, but it is a very adequate discussion and correlation of the properties of cellulosic materials that can be measured quantitatively, and should aid in stimulating further quantitative research and correlation of facts in this important field. The colloid chemistry of cellulosic materials has too long been a qualitative descriptive science. It is by the determination of the quantitative inter-relationship of the various colloidal properties that we may hope for a more intimate understanding of the physical nature of cellulose. (C)

DIRECTORY OF COMMERCIAL TESTING AND COLLEGE RESEARCH LABORATORIES. NATIONAL BUREAU OF STANDARDS MISCELLANEOUS PUBLICATION M125. Superintendent of Documents, Washington, D. C., price 15c.

Information is given concerning 244 commercial testing laboratories, with 67 branch laboratories or offices, and indications of the types of commodities which they are willing and able to test. There is also presented a list of the laboratories of 200 colleges which are used not only for purposes of instruction but also to a considerable extent for research work. (C)

FINISHING OF WOOL GOODS. John Schofield, B.Sc., A.R.C.S., and J. Colin Schofield, B.Sc. (Hons.). Published by the Authors "Moor Croft," Kirkburton, Huddersfield, England, 1935. Pp. 798, 340 illustrations. Price 30 shillings, postpaid. *Am. Dye. Rptr.*, Aug. 24, 1936, P. 477. (C)

HANDBOOK OF COLORIMETRY. The Technology Press, Cambridge, Mass. Price $5.00. *Am. Dye. Rptr.*, Aug. 24, 1936, P. 477.

Prepared by the staff of the Color Measurement Laboratory, Mass. Institute of Technology under the direction of Arthur C. Hardy, Professor of Optics and Photography. (C)